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Lin et al.

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[54] LATCH BOLT OPERATING DEVICE

[75] Inventors: **San-Yi Lin**, Yun-Lin Hsien, Taiwan; **Ching-Chuan Kuo**, Chia-Yi Hsien, Taiwan; **Tong-Pei Wu**, Chia-Yi Hsien, Taiwan; **Lan-Kun Don**, Chia-Yi Hsien, Taiwan; **Sheen-Youl Gao**, Yun-Lin Hsien, Taiwan

[73] Assignee: **Tong Lung Metal Industry Co., LTD.**, Taiwan

[21] Appl. No.: **628,848**

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[51] **Int. Cl.**[6] **E05B 9/04**

[52] **U.S. Cl.** **70/370**; 70/417; 70/449; 70/451; 70/452; 292/147; 292/357

[58] **Field of Search** 70/373, 224, 371, 70/417, 134, 370, 447–452; 292/357, 356, 147

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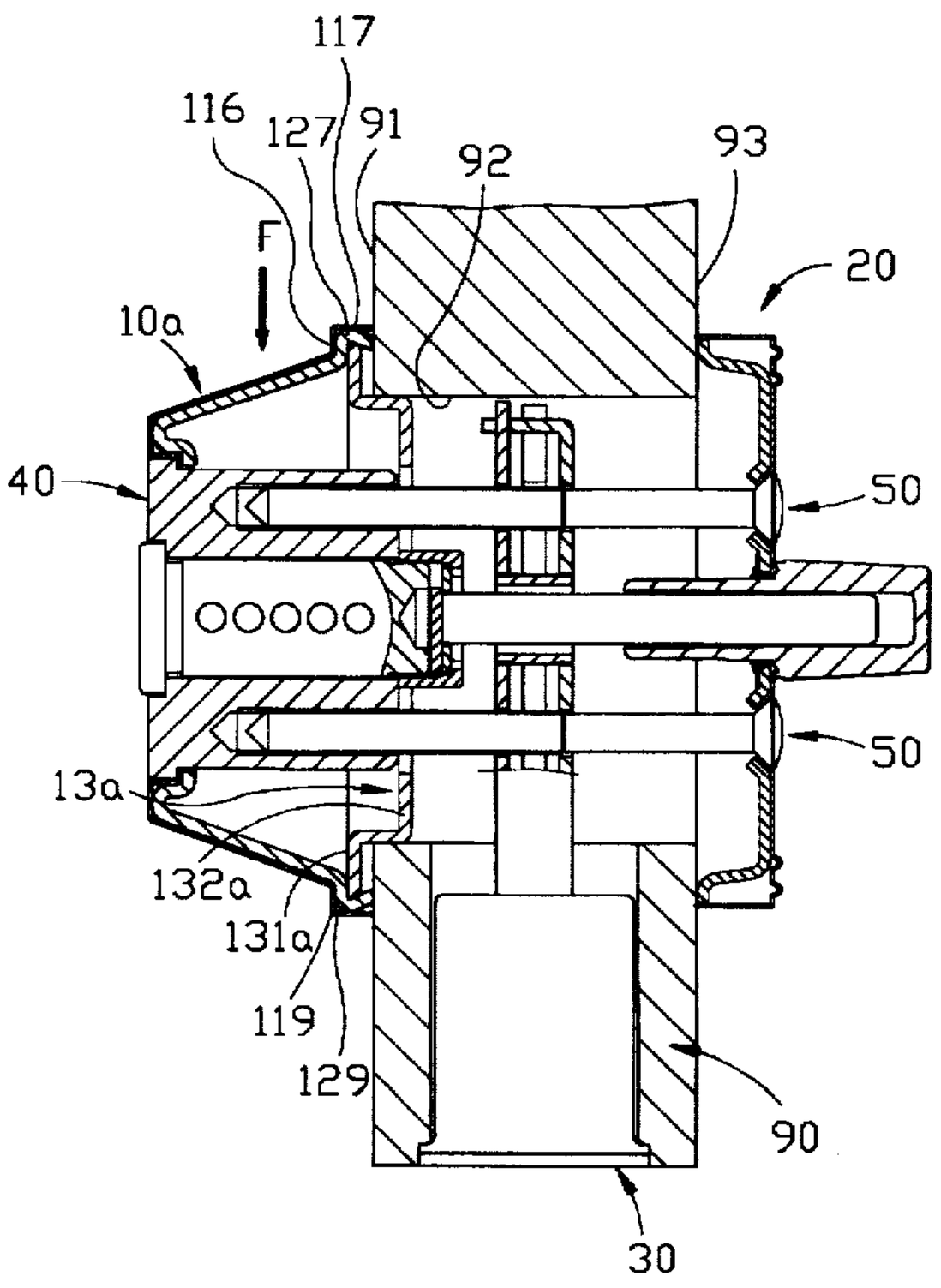
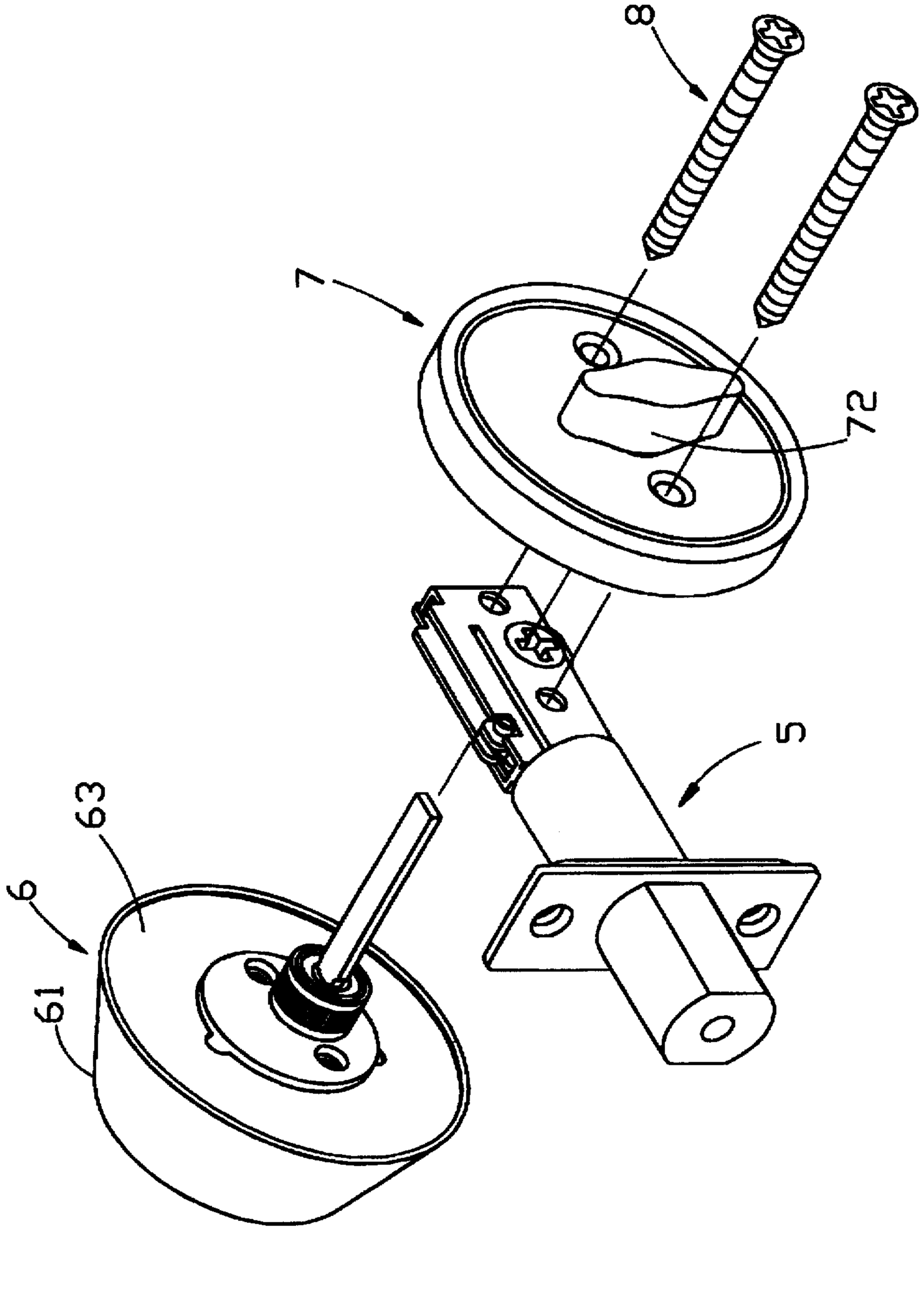
Primary Examiner—Lloyd A. Gall
Attorney, Agent, or Firm—Ladas & Parry

[57] **ABSTRACT**

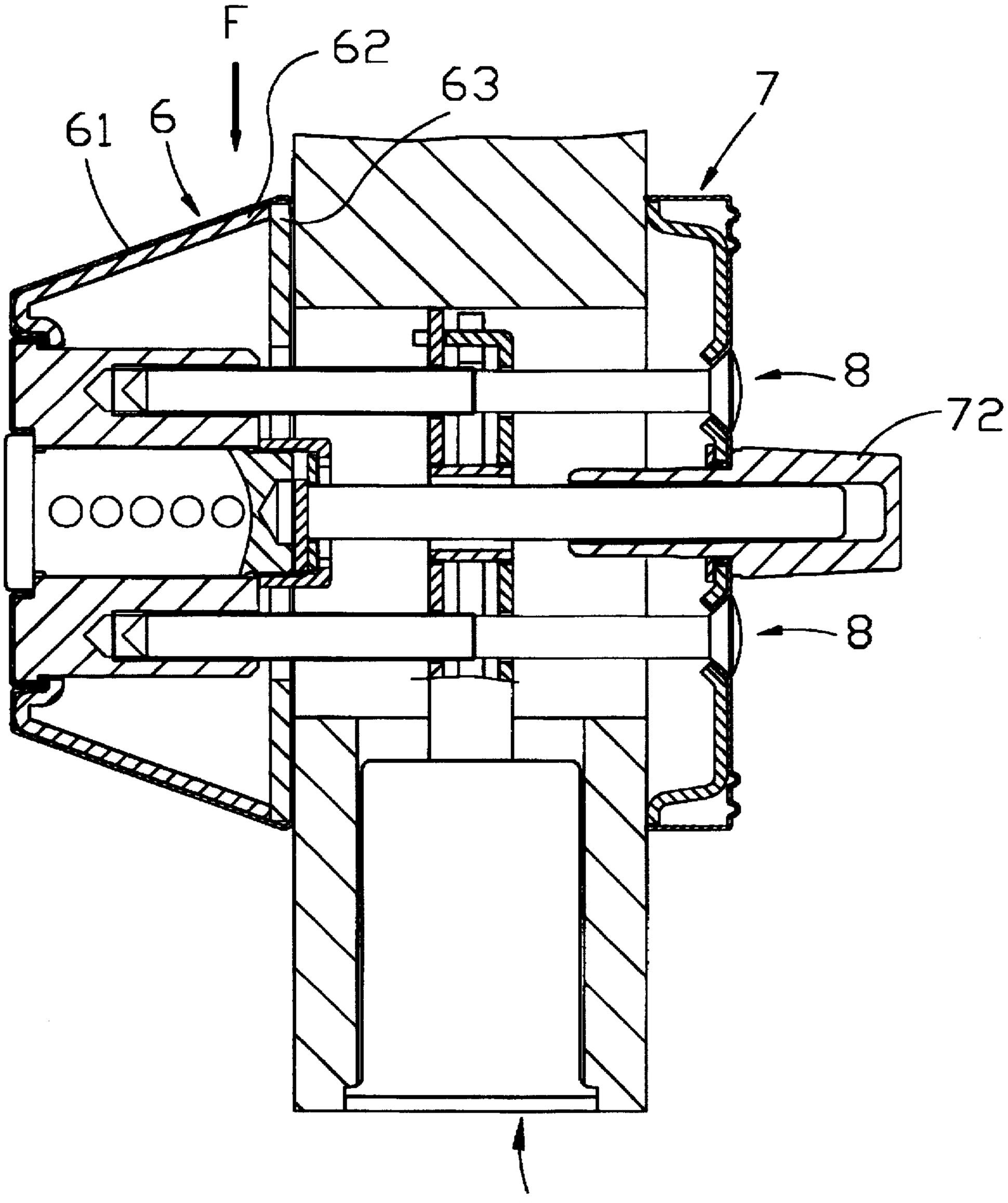
A latch bolt operating device is adapted for use with a latch bolt unit that is installed in a door panel, and includes exterior and interior operating units. The exterior operating unit includes a key-operated plug-and-cylinder lock assembly, and an exterior housing having an outer annular cover, an inner annular cover and an annular shield. The outer annular cover has a rear end portion formed with a first annular shoulder. The inner annular cover is received in the outer annular cover and has a rear end portion formed with a second annular shoulder. The annular shield extends into the rear end portion of the inner annular cover and has a peripheral portion which engages the second annular shoulder when the latter is bent. The interior operating unit includes a torque bar and an interior housing. The torque bar can be positioned releasably in a first position corresponding to an extended position of a bolt of the latch bolt unit and a second position corresponding to a retracted position of the bolt.

11 Claims, 17 Drawing Sheets





(PRIOR ART)
FIG.1



(PRIOR ART)

FIG.2

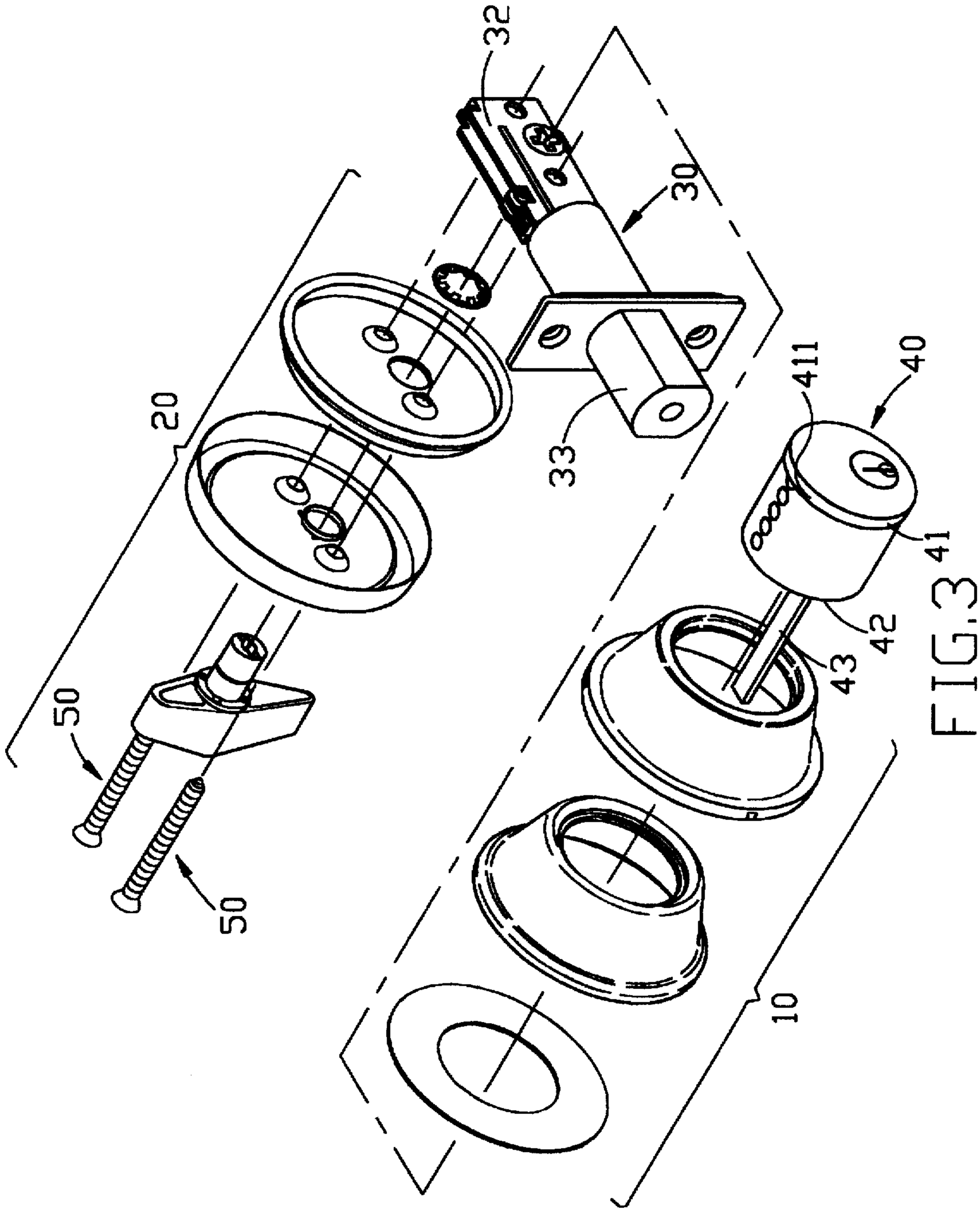


FIG.3

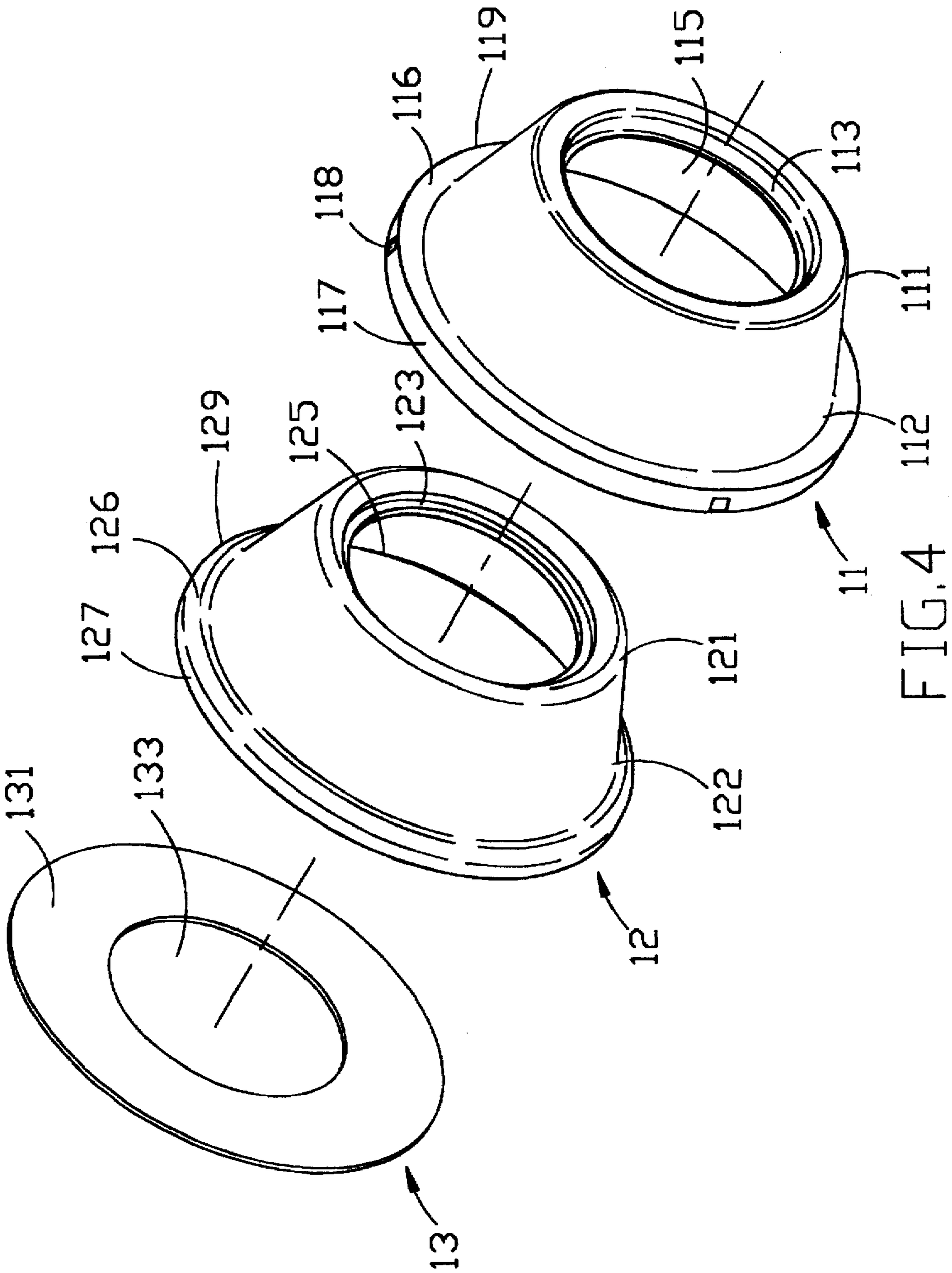

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FIG. 4

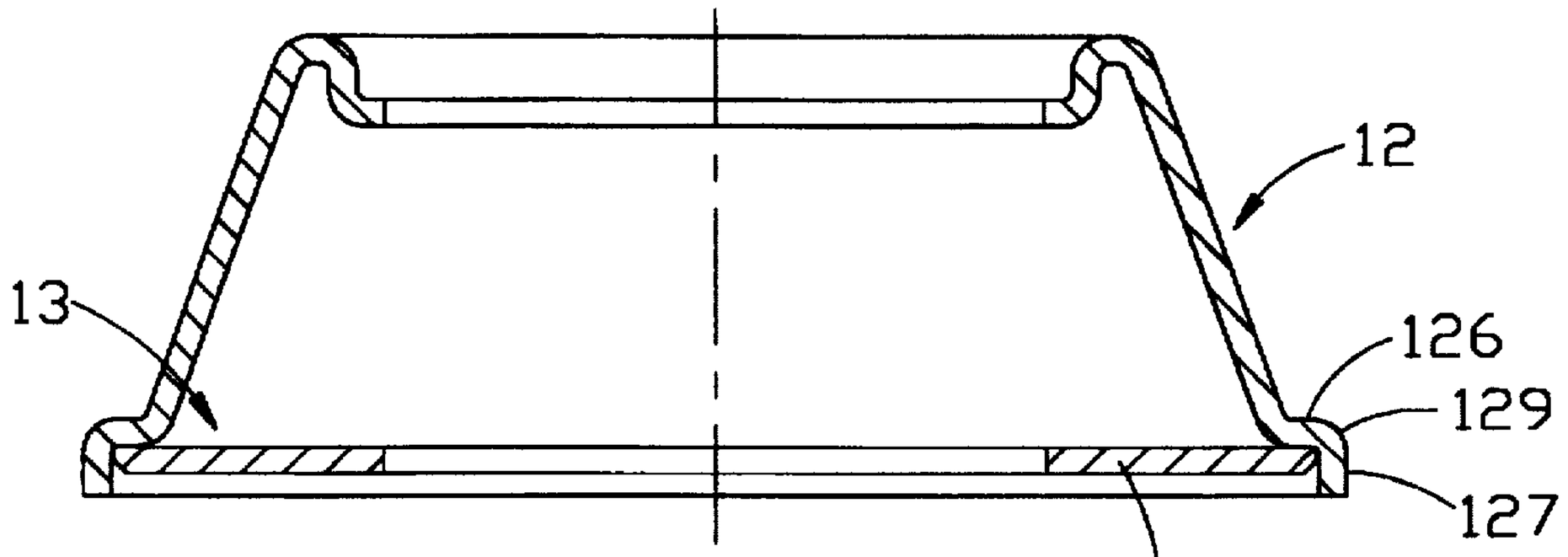

FIG.5

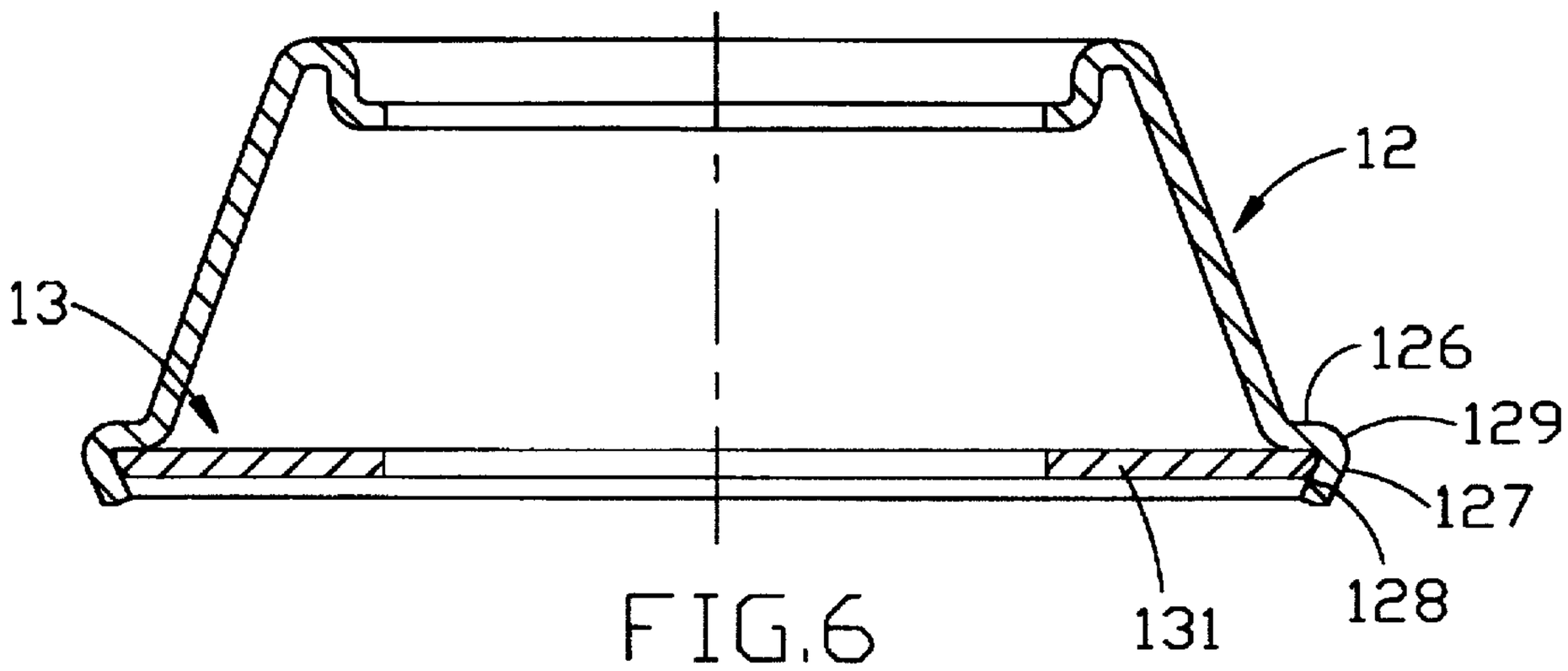

FIG.6

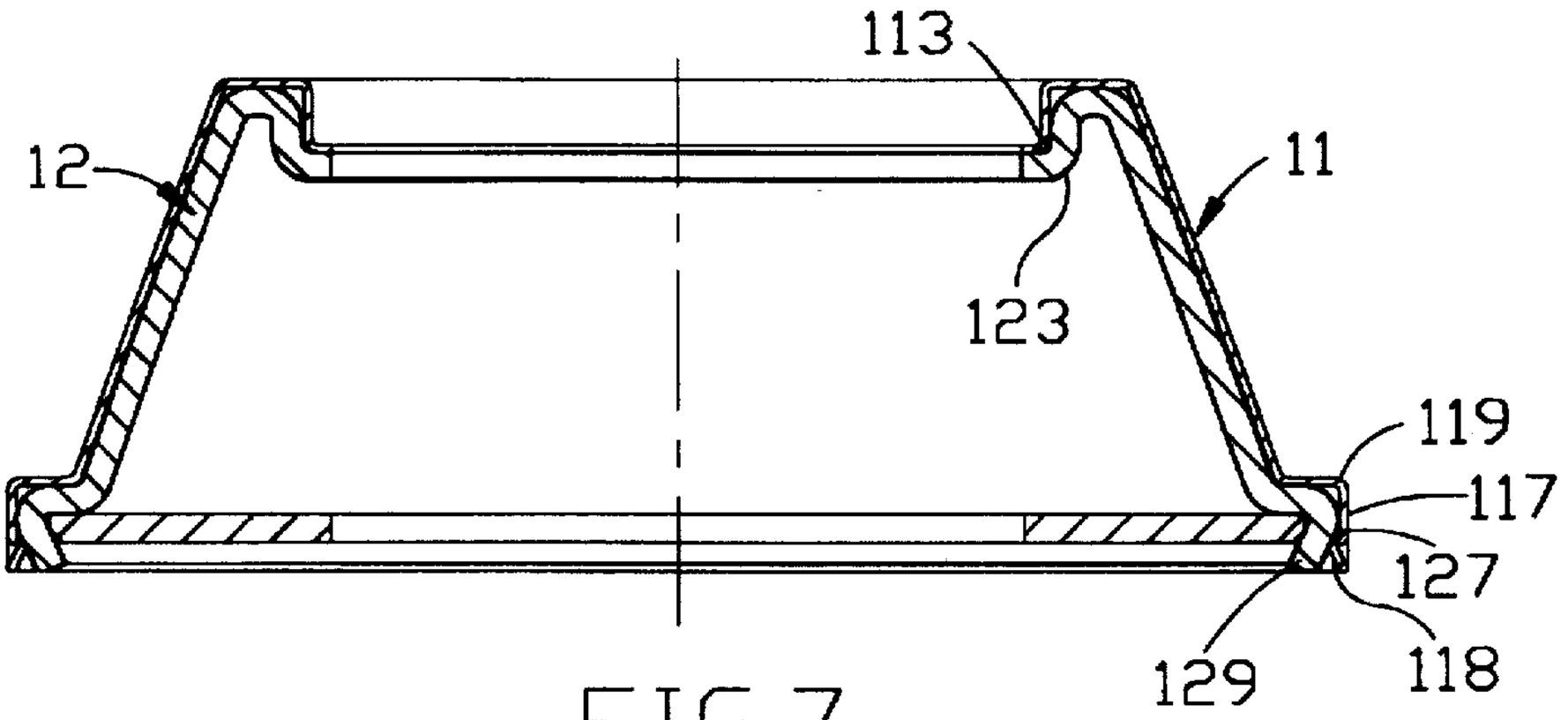

FIG.7

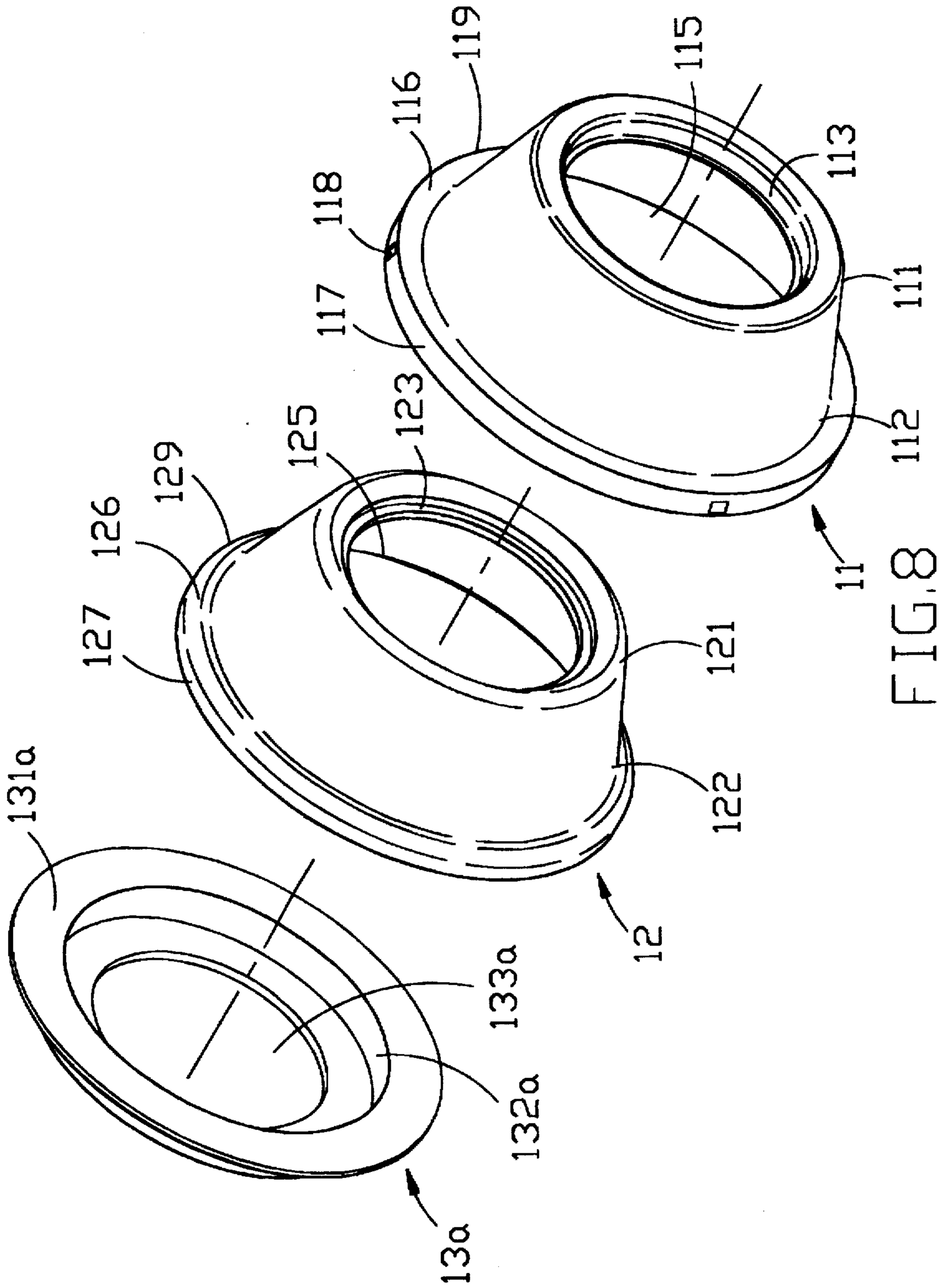
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FIG.8

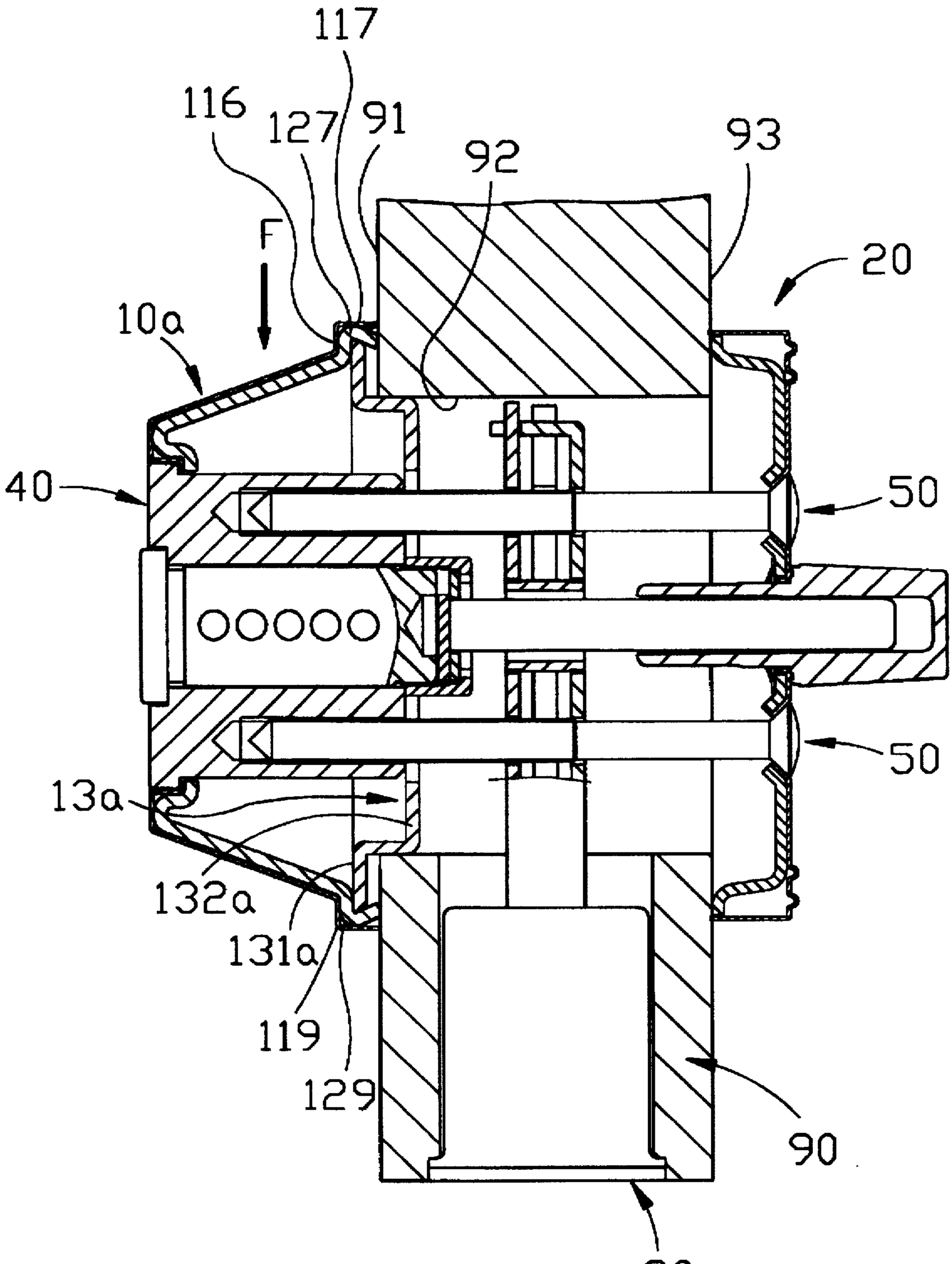


FIG.9

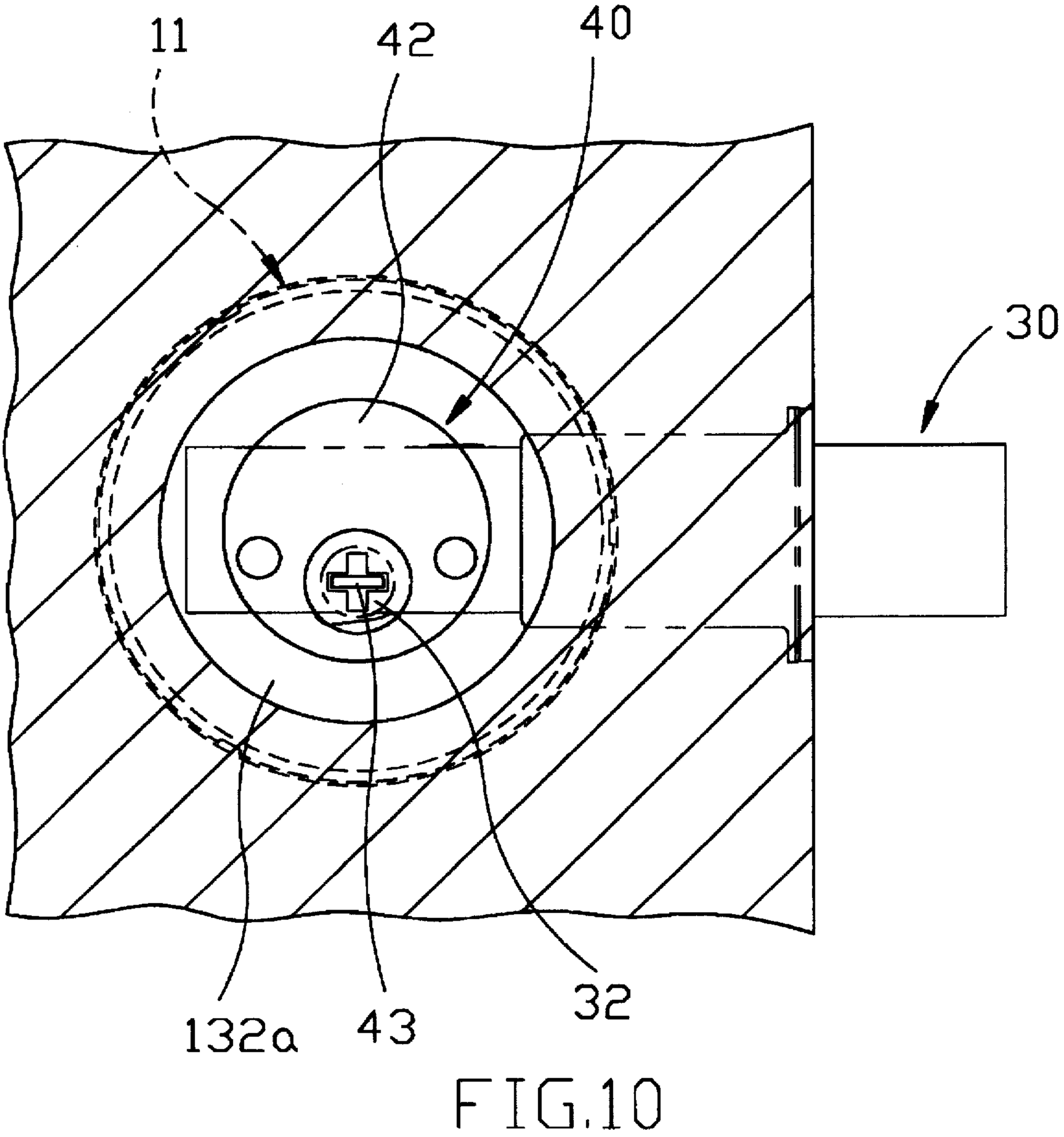
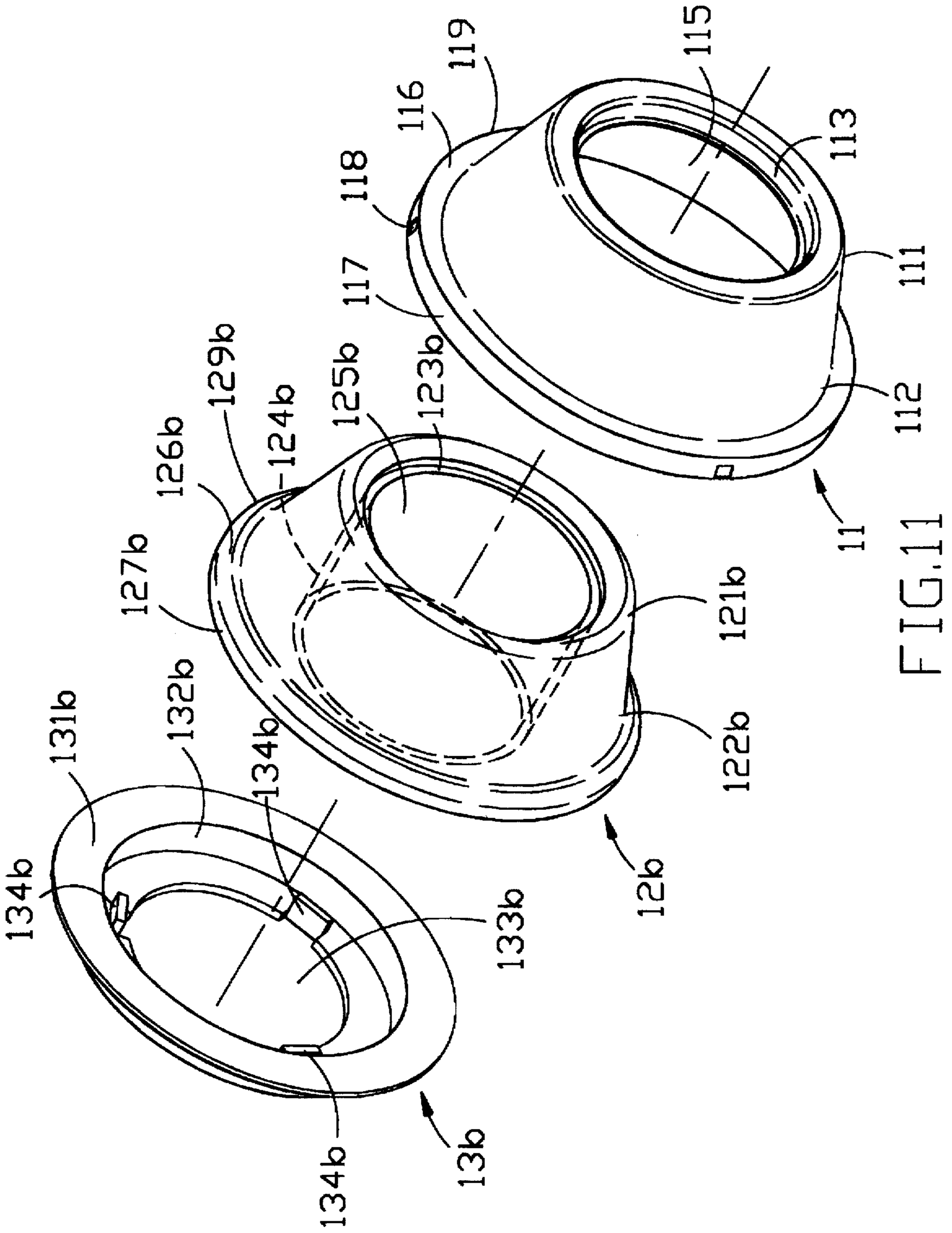


FIG.10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122b
134b
133b
12b
134b
13b

FIG.11

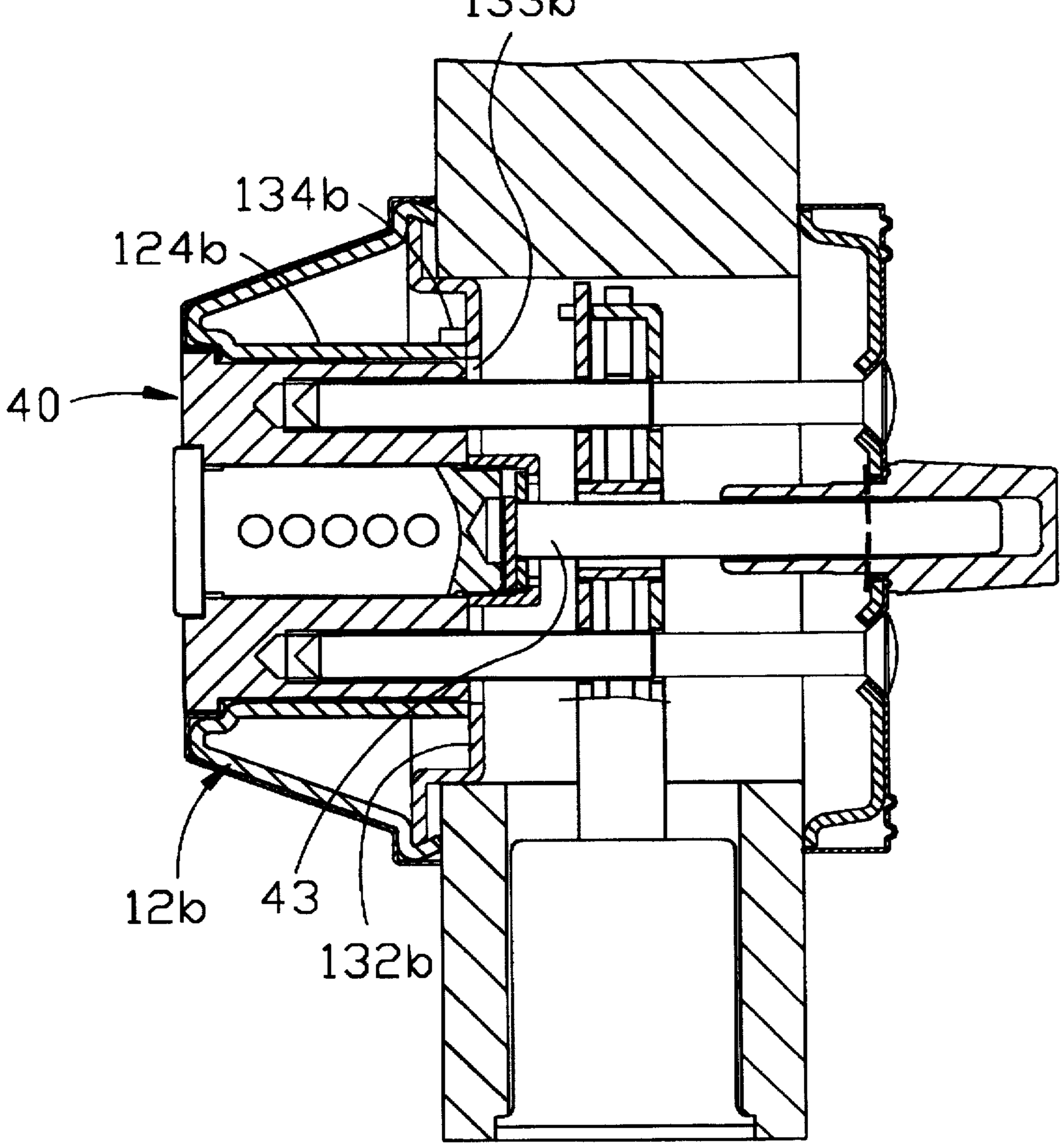

FIG.12

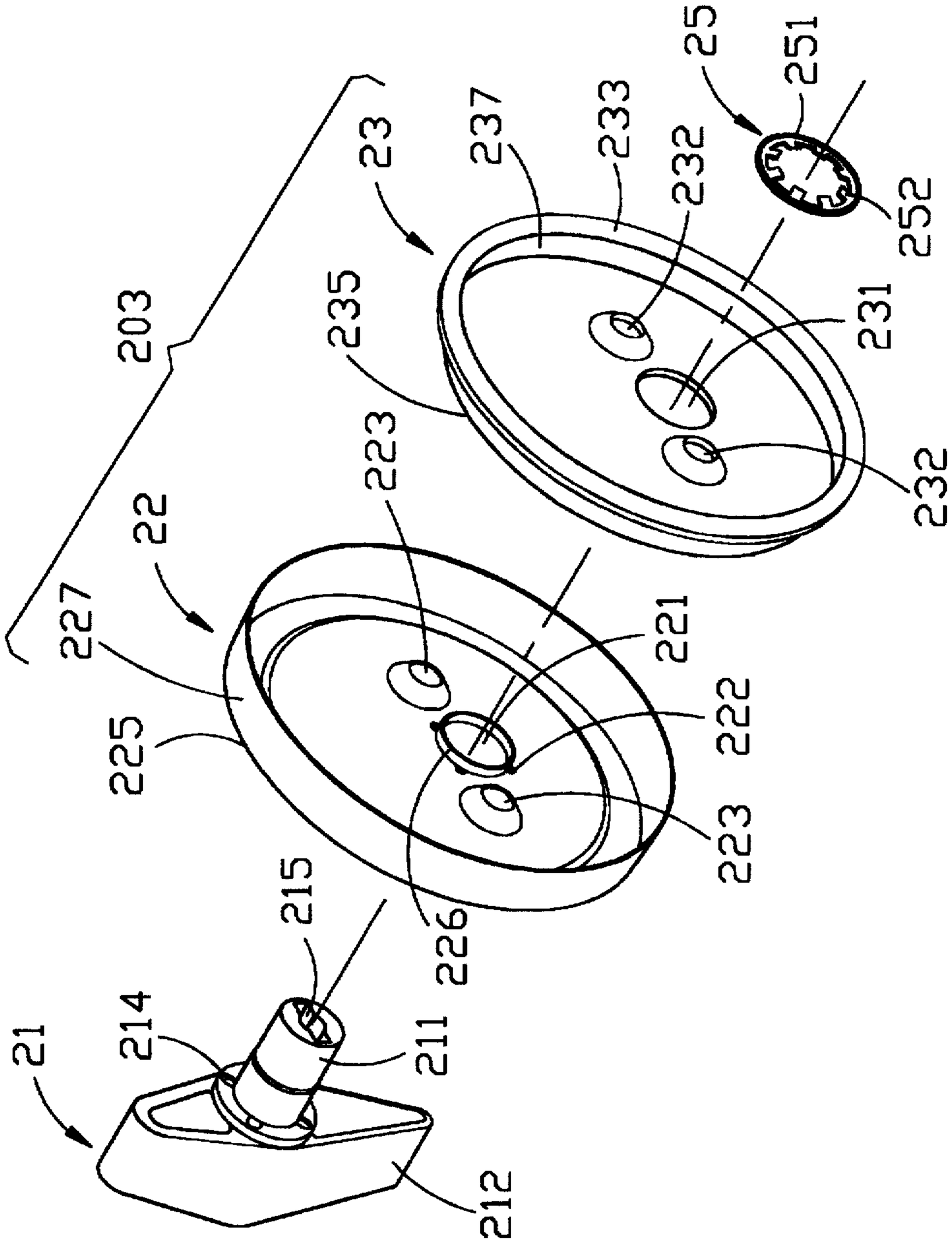
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FIG.13

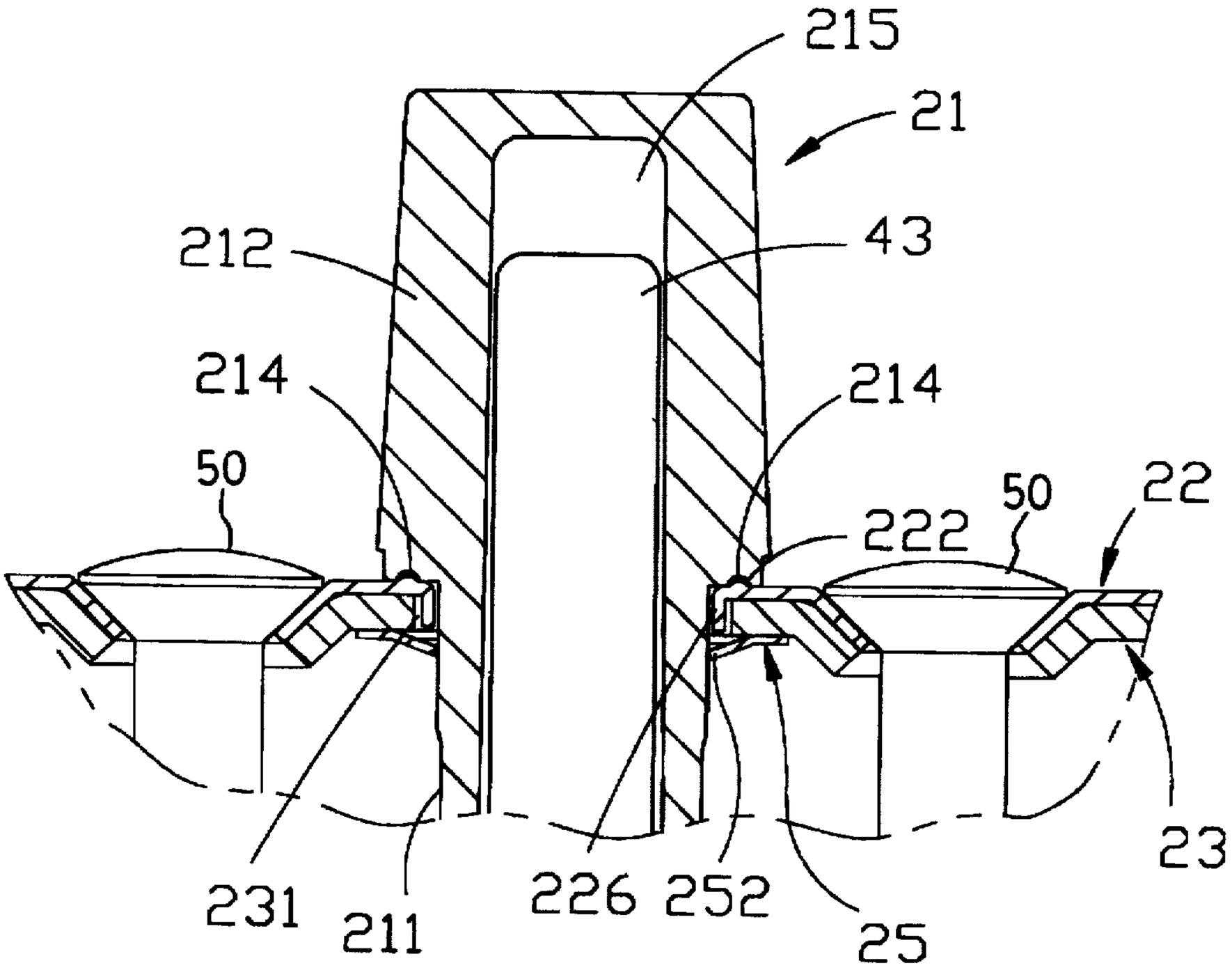
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FIG.14

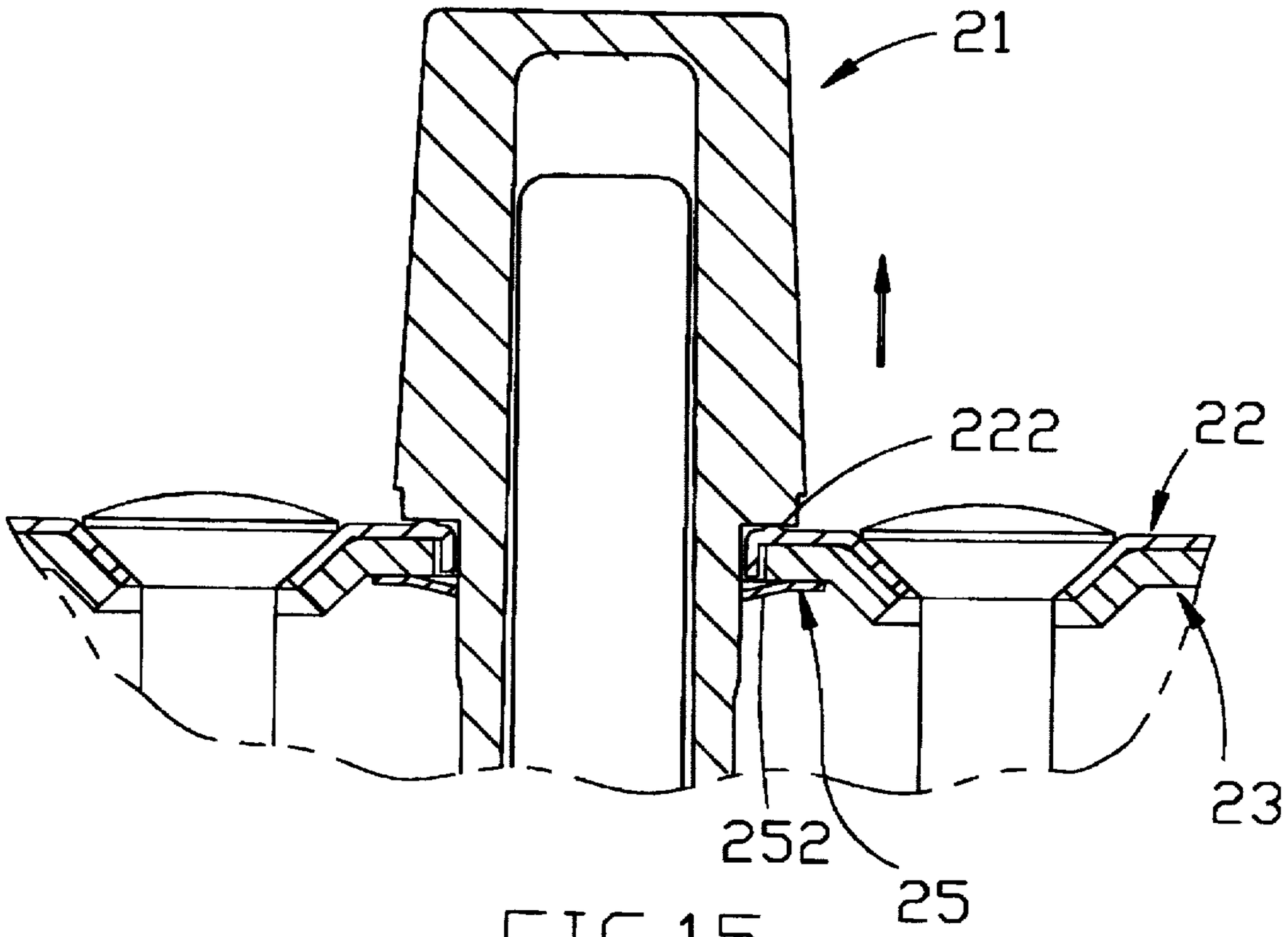
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FIG.15

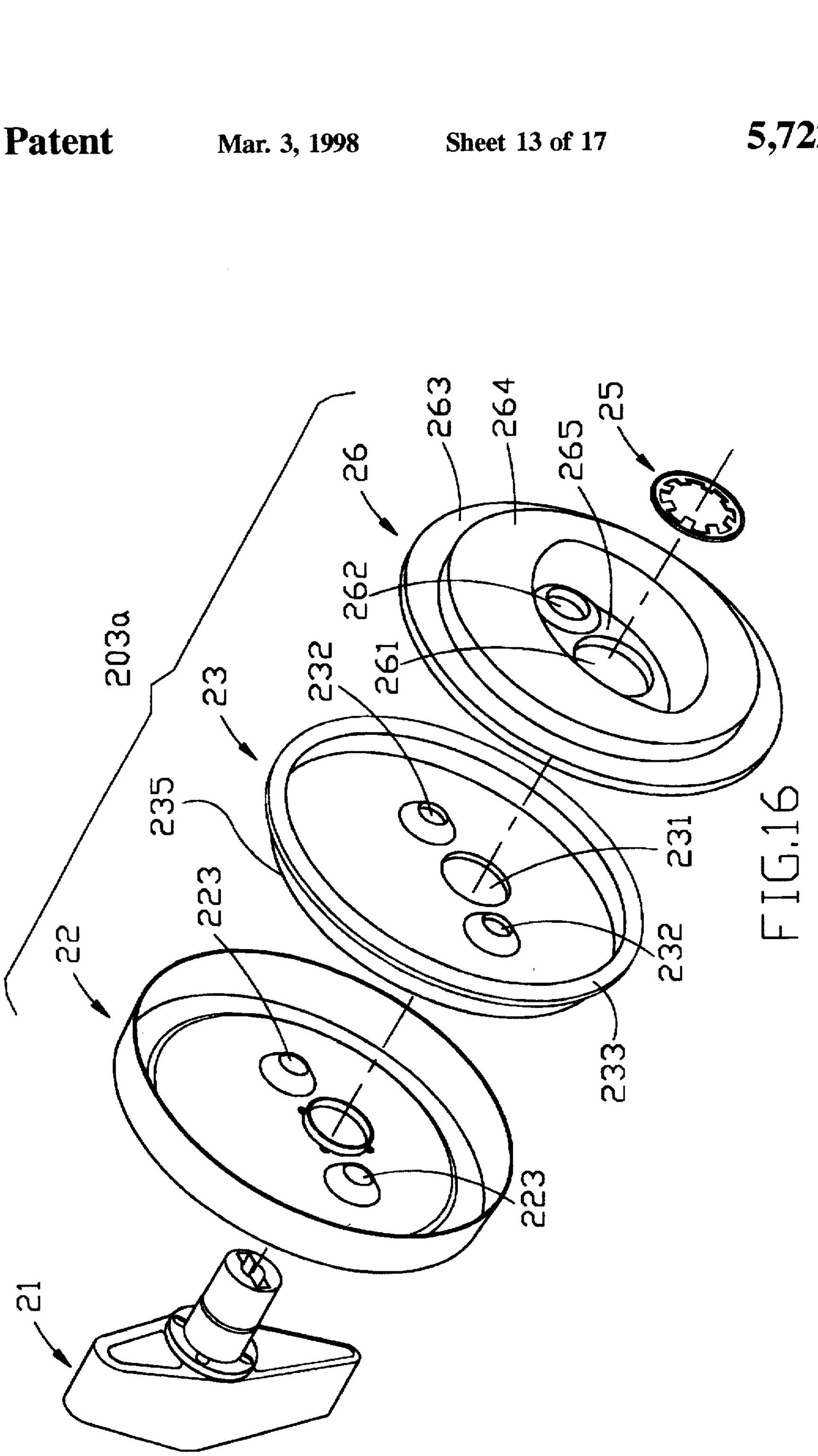

FIG.16

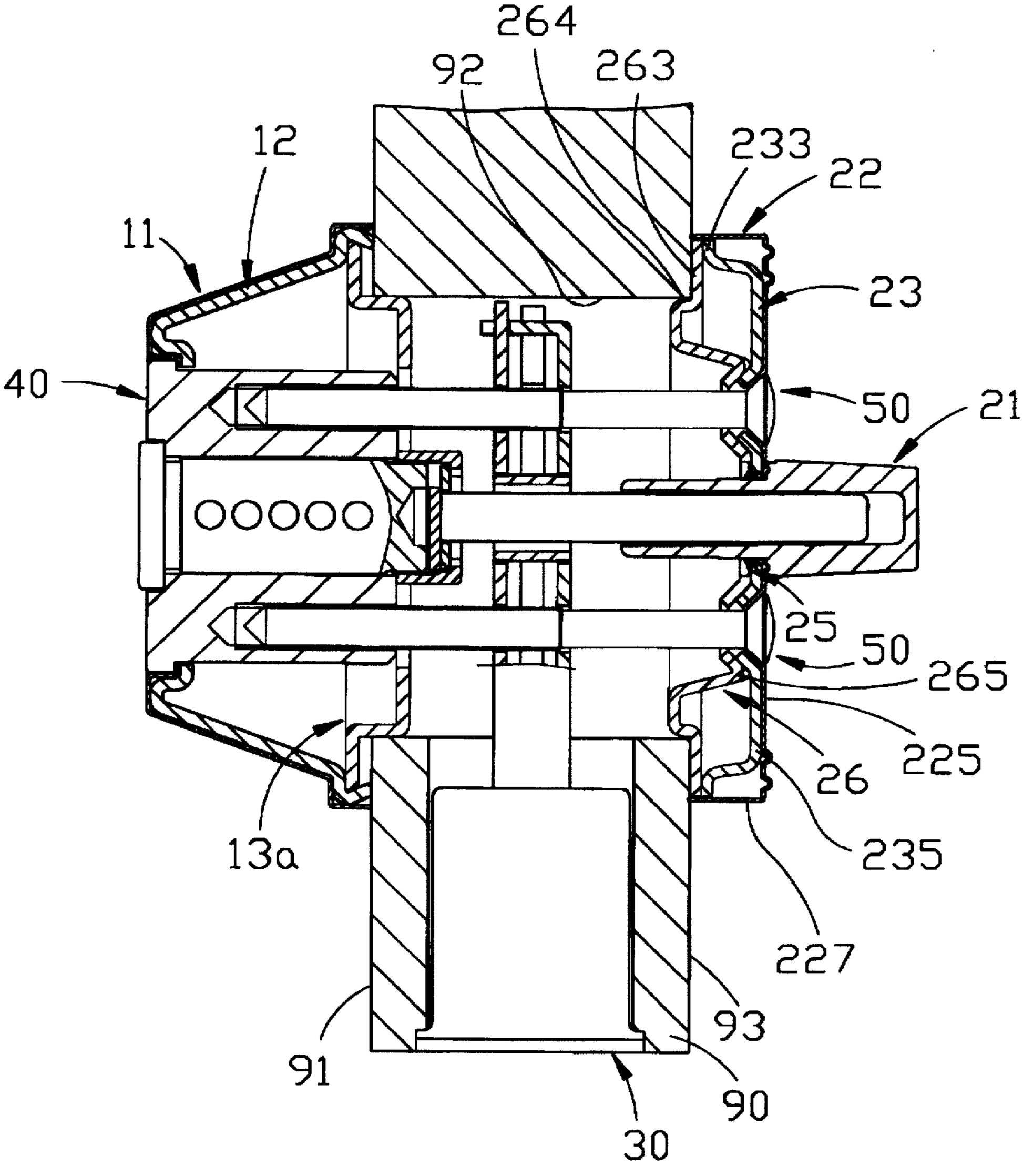
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FIG.17

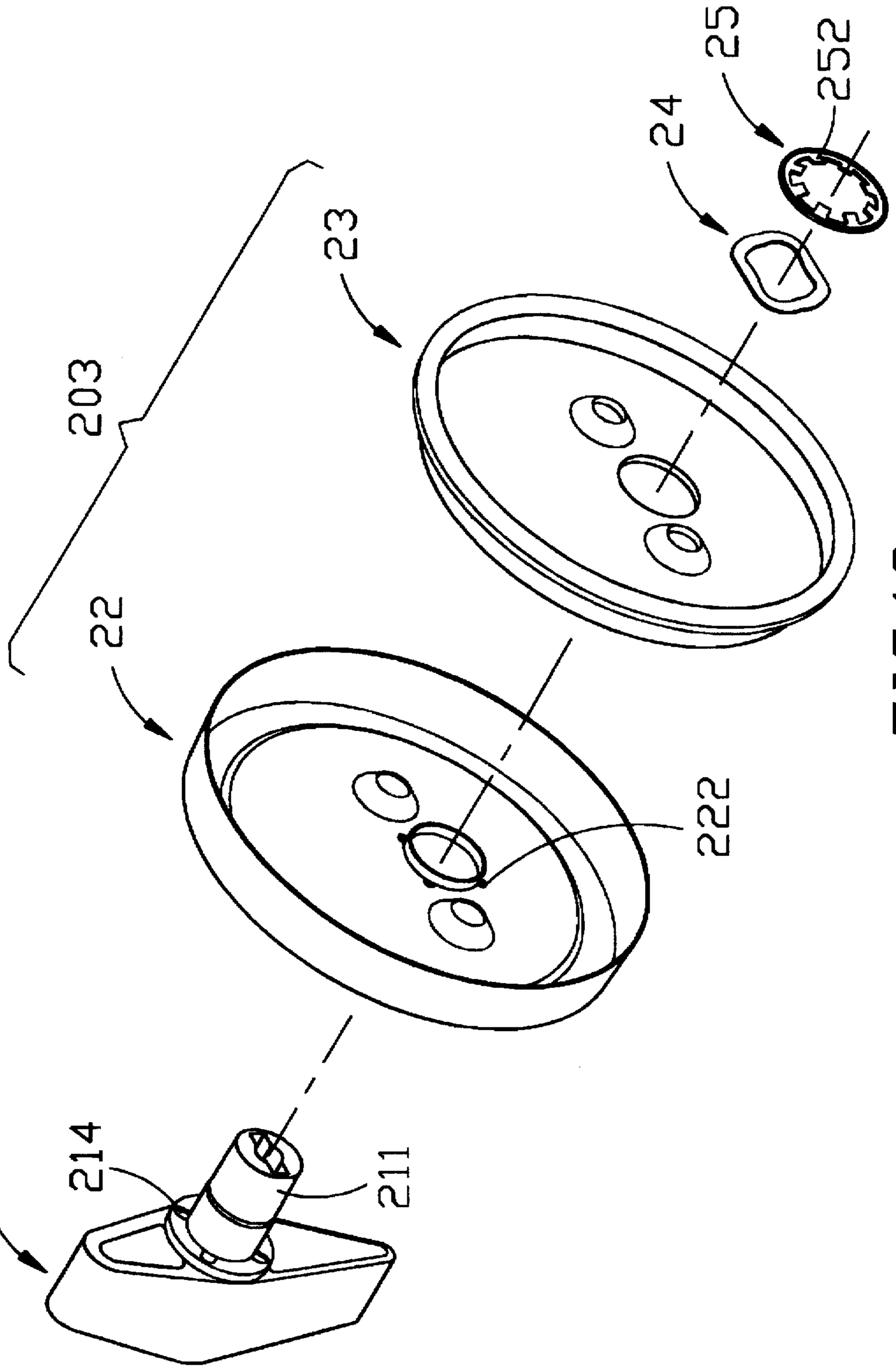

FIG.18

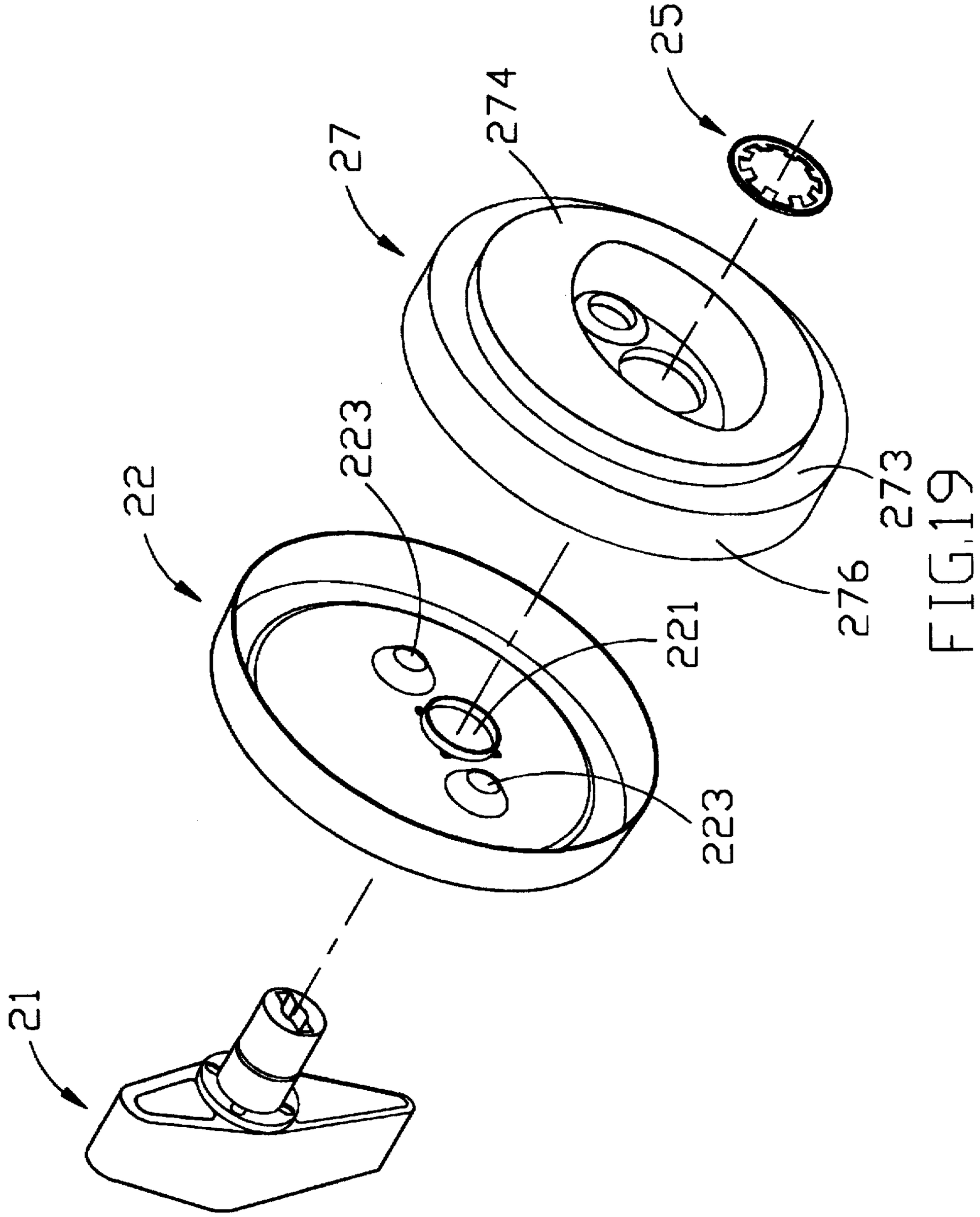

FIG.1

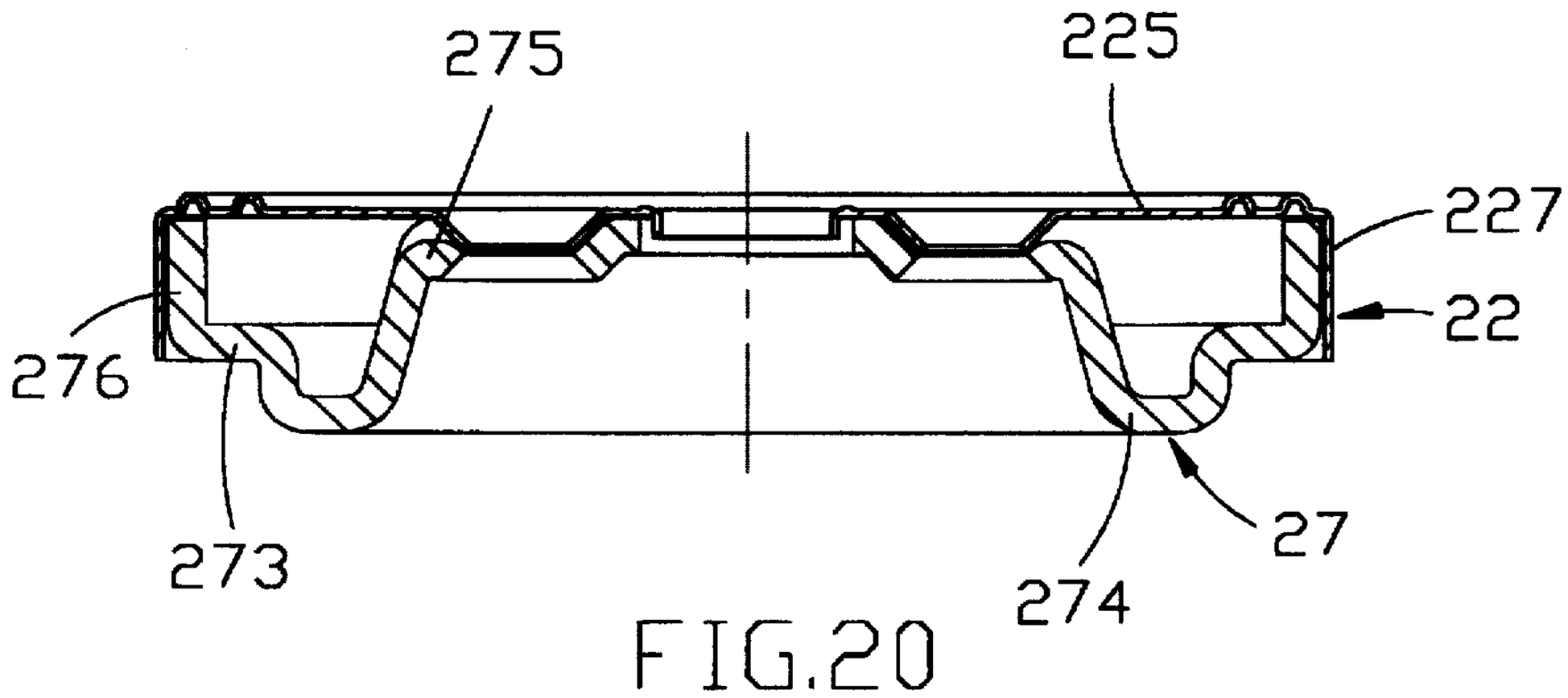

FIG.20

LATCH BOLT OPERATING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a latch bolt operating device, more particularly to a latch bolt operating device which is simple in construction, easy to install, relatively inexpensive to fabricate and which has improved strength.

2. Description of the Related Art

Referring to FIGS. **1** and **2**, a conventional door lock is shown to comprise a latch bolt unit **5** and a latch bolt operating device which includes exterior and interior operating units **6**, **7**. The exterior operating unit **6** includes an outer annular cover **61**, an inner annular cover **62** and an annular shield **63** which can be assembled to form an exterior housing. During assembly, the annular shield **63** is placed against an open end of the inner annular cover **62**. The outer annular cover **61** is sleeved over the inner annular cover **62**, and a distal end portion of the outer annular cover **61** is then bent inwardly to retain the inner annular cover **62** and the annular shield **63** therein. Usually, the outer annular cover **61** is provided with an electroplated coating. However, the electroplated coating is easily damaged when the exterior housing is assembled. Therefore, rusting of the outer annular cover **61** near the bent end portion thereof normally occurs, thus affecting adversely the appearance of the exterior housing. In addition, the connection between the outer annular cover **61** and the annular shield **63** severely limits the shape and material that can be used for the outer annular cover **61**. Furthermore, the exterior housing **6** is supported on the door panel by means of only two bolts **8**. Thus, the application of a force (F), as shown in FIG. **2**, can easily destroy the door lock.

Another drawback of the conventional latch bolt operating device resides in the structure of the interior operating unit **7**. It is noted that, when a torque bar **72** of the interior operating unit **7** is rotated, the user is unable to determine whether the latch bolt unit **5** is still in engagement with or has ceased to engage the door frame (not shown). Thus, over rotation of the torque bar **72**, which can affect the useful life of the door lock, or under rotation of the torque bar **72**, which may hinder opening of the door, are likely to occur.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a latch bolt operating device with an improved exterior operating unit which is simple in construction, easy to install, relatively inexpensive to fabricate and which has improved strength.

Another object of the present invention is to provide a latch bolt operating device with an improved interior operating unit to help minimize over rotation or under rotation of a torque bar thereof.

According to the present invention, a latch bolt operating device is adapted for use with a latch bolt unit that is installed in a door panel. The latch bolt unit includes a bolt for locking the door panel to a door frame, and a latch driving mechanism connected operably to the bolt for moving the bolt between extended and retracted positions. The latch bolt operating device comprises exterior and interior operating units.

The exterior operating unit includes: a key-operated plug-and-cylinder lock assembly having a front part formed with a radial flange, a rear part, and an actuating member which extends axially from the rear part and which is adapted to engage operably the latch driving mechanism of the latch bolt unit to move the bolt between the extended and retracted positions; and an exterior housing including an outer annular cover, an inner annular cover and an annular shield.

The outer annular cover includes a first front end portion and a first rear end portion. The outer annular cover is formed with a first axial hole which extends through the first front and the first rear end portions to permit extension of the rear part of the lock assembly therethrough. The first front end portion has a first annular recessed section around the first axial hole for receiving the radial flange of the lock assembly therein. The first rear end portion is formed with a first annular shoulder which includes a first radial part that extends outwardly from the first rear end portion, and a first axial part that extends rearwardly from the first radial part.

The inner annular cover is received in the outer annular cover and has a second front end portion, a second rear end portion and a second axial hole which extends through the second front and the second rear end portions to permit extension of the rear part of the lock assembly therethrough. The second front end portion has a second annular recessed section around the second axial hole for receiving the first annular recessed section of the outer annular cover therein. The second rear end portion is formed with a second annular shoulder which includes a second radial part that extends outwardly from the second rear end portion, and a second axial part that extends rearwardly from the second radial part.

The annular shield extends into the second rear end portion of the inner annular cover and is formed with a central hole through which the actuating member of the lock assembly extends. The second axial part is bent so as to clamp a peripheral portion of the annular shield toward the second radial part in order to retain the annular shield in the inner annular cover.

The interior operating unit includes: a torque bar having a handle portion and an actuating spindle which extends from the handle portion, the actuating spindle being adapted to be connected operably to the latch driving mechanism of the latch bolt unit to permit movement of the bolt between the extended and retracted positions when the torque bar is rotated; an interior housing including an outer cover formed with a spindle hole through which the actuating spindle extends rotatably; and positioning means for positioning releasably the torque bar in a first position corresponding to the extended position of the bolt and a second position corresponding to the retracted position of the bolt.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiments, with reference to the accompanying drawings, of which:

FIG. **1** is an exploded view of a door lock with a conventional latch bolt operating device;

FIG. **2** is a sectional view which illustrates the door lock of FIG. **1** when mounted on a door panel;

FIG. **3** is an exploded view of a door lock which incorporates the first preferred embodiment of a latch bolt operating device according to the present invention;

FIG. **4** is an exploded view of an exterior housing of the latch bolt operating device;

FIGS. **5**, **6** and **7** are sectional views which illustrate how the exterior housing of the first preferred embodiment is assembled;

FIG. **8** is an exploded view of an exterior housing of a latch bolt operating device according to the second preferred embodiment of this invention;

FIG. **9** is a sectional view which illustrates a door lock that incorporates the second preferred embodiment when installed on a door;

FIG. **10** is a sectional view of the door shown in FIG. **9**, the exterior housing of the latch bolt operating device being shown in phantom lines;

FIG. **11** is an exploded view of an exterior housing of a latch bolt operating device according to the third preferred embodiment of this invention;

FIG. **12** is a sectional view which illustrates a door lock that incorporates the third preferred embodiment when installed on a door;

FIG. **13** is an exploded view of an interior operating unit of the first preferred embodiment;

FIG. **14** is a fragmentary sectional view which illustrates the interior operating unit of FIG. **13** when assembled;

FIG. **15** is a fragmentary sectional view illustrating the interior operating unit of FIG. **13** when in use;

FIG. **16** is an exploded view of an interior operating unit of a latch bolt operating device according to the fourth preferred embodiment of this invention;

FIG. **17** is a sectional view which illustrates a door lock that incorporates the fourth preferred embodiment when installed on a door;

FIG. **18** is an exploded view of an interior operating unit of a latch bolt operating device according to the fifth preferred embodiment of this invention;

FIG. **19** is an exploded view of an interior operating unit of a latch bolt operating device according to the sixth preferred embodiment of this invention; and

FIG. **20** is a sectional view of an interior housing of the interior operating unit of the sixth preferred embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Before the present invention is described in greater detail, it should be noted that like elements are denoted by the same reference numerals throughout the disclosure.

Referring to FIG. **3**, a door lock is shown to comprise a conventional latch bolt unit **30** and the first preferred embodiment of a latch bolt operating device according to this invention. The latch bolt operating device includes exterior and interior operating units **10**, **20**.

The latch bolt unit **30** is to be installed in a door panel (not shown) and includes a bolt **33** for locking the door panel to a door frame (not shown), and a latch driving mechanism **32** connected operably to the bolt **33** for moving the latter between extended and retracted positions in a known manner.

The exterior operating unit **10** includes an exterior housing and a key-operated plug-and-cylinder lock assembly **40**. The internal configuration of the lock assembly **40** is known in the art and will not be detailed herein. The lock assembly **40** has a front part **41** formed with a radial flange **411**, a rear part **42**, and an actuating member **43** which extends axially from the rear part **42** of the lock assembly **40**. The actuating member **43** engages operably the latch driving mechanism **32** of the latch bolt unit **30** in a conventional manner so as to move the bolt **33** between the extended and retracted positions.

A pair of screws **50** extend through the interior operating unit **20** and engage threadedly with the lock assembly **40** to retain the door lock on the door.

Referring to FIG. **4**, the exterior housing of the exterior operating unit **10** is shown to comprise an outer annular cover **11**, an inner annular cover **12** and an annular shield **13**.

The outer annular cover **11** has a tapering construction with a first front end portion **111** and a wider first rear end portion **112**. The outer annular cover **11** is formed with a first axial hole **115** which extends through the first front and first rear end portions **111**, **112** and which permits extension of the rear part **42** of the lock assembly **40** therethrough. The first front end portion **111** is formed with an annular recessed section **113** around the first axial hole **115** for receiving the radial flange **411** of the lock assembly **40** therein. The first rear end portion **112** is formed with a first annular shoulder **119** which includes a first radial part **116** that extends outwardly from the first rear end portion **112**, and a first axial part **117** that extends rearwardly from the first radial part **116**. The first axial part **117** is provided with a plurality of angularly spaced and inwardly protruding bosses **118** that are formed by punching the first axial part **117** in a radial inward direction.

The inner annular cover **12** has a shape corresponding to that of the outer annular cover **11** and is to be received in the latter. The inner annular cover **12** has a second front end portion **121**, a wider second rear end portion **122** and a second axial hole **125** which extends through the second front and second rear end portions **121**, **122** and which permits extension of the rear part **42** of the lock assembly **40** therethrough. The second front end portion **121** is formed with a second annular recessed section **123** around the second axial hole **125** for receiving the first annular recessed section **113** therein. The second rear end portion **122** is formed with a second annular shoulder **129** which includes a second radial part **126** that extends outwardly from the second rear end portion **122**, and a second axial part **127** that extends rearwardly from the second radial part **126**.

The annular shield **13** includes an annular plate body **131** which is formed with a central hole **133** to permit extension of the actuating member **43** of the lock assembly **40** therethrough.

During assembly, the annular shield **13** is inserted into the second rear end portion **122** such that a peripheral portion of the annular shield **13** abuts against the second radial part **126** of the second annular shoulder **129**, as shown in FIG. **5**. The second axial part **127** of the second annular shoulder **129** is then bent in a radial inward direction so as to clamp the peripheral portion of the annular shield **13** between an inner face **128** of the second axial part **127** and the second radial part **126** of the second annular shoulder **129**, thereby retaining the annular shield **13** in the inner annular cover **12**, as shown in FIG. **6**. The outer annular cover **11** is then sleeved over the inner annular cover **12**, as shown in FIG. **7**. At this time, the second annular recessed section **123** of the inner annular cover **12** receives the first annular recessed section **113** of the outer annular cover **11**, and the bosses **118** on the first axial part **117** of the first annular shoulder **119** abut against the second axial part **127** of the second annular shoulder **129**, thereby retaining the inner annular cover **12** in the outer annular cover **11**. Preferably, the length of the first axial part **117** should be sufficient so as to conceal the second annular shoulder **129** and so as to abut against an outer side **91** of the door panel **90** when the exterior housing is installed on the latter, as shown in FIG. **9**.

It has thus been shown that the inner annular cover **12** can be retained within the outer annular cover **11** without the need for bending the first annular shoulder **119** of the outer annular cover **11**. Thus, the electroplated coating on the

outer annular cover **11** is not damaged when the exterior housing is assembled, thereby preventing rusting of the outer annular cover **11**. In addition, the connection between the outer annular cover **11** and the inner annular cover **12** permits replacement of the former with another cover member that has a different shape and that is made of a different material.

The exterior housing of a latch bolt operating device according to the second preferred embodiment of this invention is shown in FIG. **8** to be generally similar to that of the previous embodiment, the main difference residing in the construction of the annular shield **13***a*. As illustrated, the annular shield **13***a* includes an annular plate body **131***a* which is formed with a central hole **133***a* to permit extension of the actuating member of the lock assembly therethrough. However, the plate body **131***a* further has an inner peripheral portion formed with a rearwardly and axially extending annular extension **132***a*.

Referring to FIG. **9**, when the exterior operating unit **10***a* of the second preferred embodiment is installed on a door panel **90**, the annular extension **132***a* of the annular shield **13***a* extends into and abuts against a wall surface of a door hole **92** that is formed through outer and inner sides **91**, **93** of the door panel **90**. Thus, the annular extension **132***a* serves to anchor the exterior housing in order to strengthen the door lock which incorporates the second preferred embodiment of this invention so that the door lock is not easily destroyed when a force (F) is applied by a thief.

Referring to FIGS. **8**, **9** and **10**, the rear part **42** of the lock assembly **40** is extended through the axial holes **115**, **125** in the outer and inner annular covers **11**, **12** when the lock assembly **40** is installed in the exterior housing. The axial holes **115**, **125** guide movement of the lock assembly **40** to ensure proper engagement between the actuating member and the latch driving mechanism of the latch bolt unit **30**. The screws **50** are then extended through the interior operating unit **20** so as to engage threadedly with the lock assembly **40** in order to retain the door lock on the door panel **90**, as shown in FIG. **9**.

FIG. **11** is an exploded view of an exterior housing of a latch bolt operating device according to the third preferred embodiment of this invention. The exterior housing of this embodiment is generally similar to that of the second preferred embodiment, the main difference residing in the constructions of the inner annular cover **12***b* and the annular shield **13***b*.

The inner annular cover **12***b* has a front end portion **121***b*, a wider rear end portion **122***b* and an axial hole **125***b* which extends through the front and rear end portions **121***b*, **122***b*. The front end portion **121***b* is formed with an annular recessed section **123***b* around the hole **125***b*, and a tubular post **124***b* which extends rearwardly and axially from the annular recessed section **123***b* and which confines the axial hole **125***b* therein. The rear end portion **122***b* is formed with an annular shoulder **129***b* which includes a radial part **126***b* that extends outwardly from the rear end portion **122***b*, and an axial part **127***b* that extends rearwardly from the radial part **126***b*.

The annular shield **13***b* includes an annular plate body **131***b* which is formed with a central hole **133***b* and which has an inner peripheral portion that is provided with a rearwardly and axially extending annular extension **132***b*. The annular extension **132***b* has a radial inward end wall with an inner peripheral portion that is provided with a plurality of angularly spaced and forwardly extending guide blocks **134***b*. As shown in FIG. **12**, the guide blocks **134***b*, which are formed by punching the end wall of the annular extension **132***b* in an axial forward direction, slidably engage the tubular post **124***b* of the inner annular cover **12***b* to strengthen a door lock which incorporates the third preferred embodiment.

Referring to FIG. **13**, the interior operating unit of the first preferred embodiment of the latch operating device according to the present invention is shown to comprise a torque bar **21**, an interior housing **203** and a biasing unit. The interior housing **203** includes an outer cover **22** and an inner cover **23**.

The torque bar **21** has a handle portion **212** and an actuating spindle **211** which extends from a rear side of the handle portion **212**. The actuating spindle **211** is connected operably to the latch driving mechanism **32** of the latch bolt unit **30** (see FIG. **3**) in a conventional manner so as to permit movement of the bolt **33** between the extended and retracted positions when the torque bar **21** is rotated. The rear side of the handle portion **212** is formed with a plurality of angularly spaced positioning recesses **214**. In this embodiment, the actuating spindle **211** is a hollow member which is formed with an axial engaging hole **215** for engaging one end of the actuating member **43** of the lock assembly **40**, as shown in FIG. **14**.

The outer cover **22** includes a circular first plate body **225** and a first peripheral skirt **227** which extends rearwardly from the first plate body **225** and which is adapted to contact the inner side of a door panel when the interior operating unit is installed. The first plate body **225** is formed with a spindle hole **221** through which the actuating spindle **211** of the torque bar **21** extends rotatably. The first plate body **225** is further formed with a tubular extension **226** which extends rearwardly and which is disposed around the spindle hole **221**, a plurality of angularly spaced rounded positioning protrusions **222** disposed at a front surface of the first plate body **225** to engage slidably the positioning recesses **214** in the handle portion **212** of the torque bar **21**, and a pair of mounting holes **223** at opposite sides of the spindle hole **221** to permit extension of the screws **50** therethrough, as shown in FIG. **14**. The positioning recesses **214** and the positioning protrusions **222** constitute a positioning unit for positioning releasably the torque bar **21** in a first position corresponding to the extended position of the bolt **33** and a second position corresponding to the retracted position of the bolt **33**.

The inner cover **23** extends into the outer cover **22** and includes a circular second plate body **235** and a second peripheral skirt **237** which extends rearwardly from the second plate body **235**. The second plate body **235** is formed with a through-hole **231** through which the tubular extension **226** on the outer cover **22** extends, as shown in FIG. **14**. The second peripheral skirt **237** is formed with a radial outward flange **233** which extends to the first peripheral skirt **227** of the outer cover **22** when the inner cover **23** is disposed in the latter and which is adapted to be placed against the inner side of the door panel when the interior operating unit is installed on the same. The second plate body **235** is further formed with a pair of mounting holes **232** that are aligned with the mounting holes **223** in the outer cover **22**.

In this embodiment, the biasing unit includes an internally toothed washer **25**. The washer **25** is formed as a ring **251** with an inner periphery that is provided with a plurality of angularly spaced resilient teeth **252**. Referring to FIG. **14**, the washer **25** is sleeved on the actuating spindle **211** of the torque bar **21** at a rear side of the inner cover **23** such that the resilient teeth **252** of the washer **25** engage the surface of the actuating spindle **211** to provide resistance against

axial movement of the actuating spindle **211** away from the interior housing **203**.

As shown in FIG. **15**, when the torque bar **21** is rotated relative to the interior housing **203** from the first position to the second position, sliding disengagement between the positioning recesses **214** and the positioning projections **222** occurs. At this time, the actuating spindle **211** moves axially away from the interior housing **203** to result in deformation of the resilient teeth **252** of the washer **25**. When the torque bar **21** reaches the second position, the positioning projections **222** engage the positioning recesses **214**, thereby enabling the resilient teeth **252** to pull the actuating spindle **211** toward the interior housing **203**. Thus, in view of the novel construction of the interior operating unit, over rotation or under rotation of the torque bar **21** can be avoided.

Referring to FIGS. **16** and **17**, the interior housing **203***a* of the interior operating unit of a latch bolt operating device according to the fourth preferred embodiment of this invention is shown to further comprise a reinforcing shield **26**. Preferably, the reinforcing shield **26** has a raised circular portion **265** which extends toward the second plate body **235** of the inner cover **23**, and an annular recessed portion **264** around the raised circular portion **265**. When the interior operating unit of this embodiment is installed on the door panel **90**, the recessed portion **264** of the reinforcing shield **26** extends into and abuts against a wall surface of the door hole **92** that is formed through the outer and inner sides **91**, **93** of the door panel **90**. Thus, the reinforcing shield **26** serves to anchor the interior housing to the door panel **90** in order to strengthen the interior operating unit against forces that are exerted by the screws **50** when the interior operating unit is installed on the door panel **90**. The reinforcing shield **26** is further provided with an annular peripheral portion **263** which extends around the recessed portion **264** to the first peripheral skirt **227** on the outer cover **22** when the reinforcing shield **26** is disposed in the latter. The peripheral portion **263** is clamped between the outward flange **233** of the inner cover **23** and the inner side **93** of the door panel **90**. The raised circular portion **265** is formed with a hole **261** and a pair of mounting holes **262** that are aligned with the hole **231** and the mounting holes **232** in the inner cover **23**, respectively.

Referring to FIG. **18**, the interior operating unit of the fifth preferred embodiment of a latch operating device according to the present invention is shown to be substantially similar to that of the first preferred embodiment, the main difference residing in that the biasing unit further includes a wavy annular spring **24** which is sleeved on the actuating spindle **211** between the washer **25** and the inner cover **23**. The annular spring **24** enhances the biasing effect of the biasing unit.

The interior housing of an interior operating unit of the latch bolt operating device according to the sixth preferred embodiment of this invention is shown in FIGS. **19** and **20**. As illustrated, the interior housing of this embodiment includes an inner cover **27** which replaces the inner cover **23** and the reinforcing shield **26** of the interior housing of the fourth preferred embodiment. The inner cover **27** has a raised circular portion **275** which extends toward the first plate body **225** of the outer cover **22**, and an annular recessed portion **274** around the raised circular portion **275**. As with the reinforcing shield **26** of the fourth preferred embodiment, the recessed portion **274** extends into and abuts against a wall surface of a door hole that is formed through outer and inner sides of a door panel (not shown) when the interior operating unit is installed on the same. The inner cover **27** is further provided with an annular peripheral portion **273** which extends around the recessed portion **274** to the first peripheral skirt **227** of the outer cover **22** when the inner cover **27** is inserted into the latter. The peripheral portion **273** abuts against the inner side of the door panel when the interior operating unit is installed. The inner cover **27** is further provided with a tubular wall **276** that extends from the peripheral portion **273** toward the first plate body **225** of the outer cover **22**.

While the present invention has been described in connection with what is considered the most practical and preferred embodiments, it is understood that this invention is not limited to the disclosed embodiments but is intended to cover various arrangements included within the spirit and scope of the broadest interpretation so as to encompass all such modifications and equivalent arrangements.

We claim:

1. A housing for a lock assembly, comprising:

an outer annular cover including a first front end portion and a first rear end portion, said outer annular cover being formed with a first axial hole which extends through said first front and said first rear end portions and which is adapted to permit extension of the lock assembly therethrough, said first rear end portion being formed with a first annular shoulder which includes a first radial part that extends outwardly from said first rear end portion, and a first axial part that extends rearwardly from said first radial part;

an inner annular cover being received in said outer annular cover and having a second front end portion, a second rear end portion and a second axial hole which extends through said second front and said second rear end portions and which is adapted to permit extension of the lock assembly therethrough, said second rear end portion being formed with a second annular shoulder which includes a second radial part that extends outwardly from said second rear end portion, and a second axial part that extends rearwardly from said second radial part;

said first axial part of said first annular shoulder being provided with at least one inwardly protruding boss that abuts against said second axial part of said second annular shoulder to retain said inner annular cover in said outer annular cover; the lock assembly having a front part formed with a radial flange, wherein said first front end portion has a first annular recessed section around said first axial hole and adapted for receiving the radial flange of the lock assembly therein, said second front end portion having a second annular recessed section around said second axial hole for receiving said first annular recessed section of said outer annular cover therein.

2. The housing of claim **1**, further comprising an annular shield that extends into said second rear end portion of said inner annular cover, said second axial part being bent so as to clamp a peripheral portion of said annular shield toward said second radial part in order to retain said annular shield in said inner annular cover.

3. The housing of claim **1**, wherein said boss is formed by punching said first axial part of said first annular shoulder in a radial inward direction.

4. A latch bolt operating device adapted for use with a latch bolt unit that is installed in a door panel, the latch bolt unit including a bolt for locking the door panel to a door frame, and a latch driving mechanism connected operably to the bolt for moving the bolt between extended and retracted positions, said latch bolt operating device comprising:

an exterior operating unit including:

a key-operated plug-and-cylinder lock assembly having a front part formed with a radial flange, a rear part, and an actuating member which extends axially from said rear part and which is adapted to engage operably the latch driving mechanism of the latch bolt unit to move the bolt between the extended and retracted positions; and

an exterior housing including an outer annular cover, an inner annular cover and an annular shield;

said outer annular cover including a first front end portion and a first rear end portion, said outer annular cover being formed with a first axial hole which extends through said first front and said first rear end portions to permit extension of said rear part of said lock assembly therethrough, said first front end portion having a first annular recessed section around said first axial hole for receiving said radial flange of said lock assembly therein, said first rear end portion being formed with a first annular shoulder which includes a first radial part that extends outwardly from said first rear end portion, and a first axial part that extends rearwardly from said first radial part;

said inner annular cover being received in said outer annular cover and having a second front end portion, a second rear end portion and a second axial hole which extends through said second front and said second rear end portions to permit extension of said rear part of said lock assembly therethrough, said second front end portion having a second annular recessed section around said second axial hole for receiving said first annular recessed section of said outer annular cover therein, said second rear end portion being formed with a second annular shoulder which includes a second radial part that extends outwardly from said second rear end portion, and a second axial part that extends rearwardly from said second radial part;

said annular shield extending into said second rear end portion of said inner annular cover and being formed with a central hole through which said actuating member of said lock assembly extends;

said second axial part being bent so as to clamp a peripheral portion of said annular shield toward said second radial part in order to retain said annular shield in said inner annular cover; and

an interior operating unit including:

a torque bar having a handle portion and an actuating spindle which extends from said handle portion, said actuating spindle being adapted to be connected operably to the latch driving mechanism of the latch bolt unit to permit movement of the bolt between the extended and retracted positions when said torque bar is rotated;

an interior housing including an outer cover formed with a spindle hole through which said actuating spindle extends rotatably; and

positioning means for positioning releasably said torque bar in a first position corresponding to the extended position of the bolt and a second position corresponding to the retracted position of the bolt.

5. A latch bolt operating device adapted for use with a latch bolt unit that is installed in a door panel, the latch bolt unit including a bolt for locking the door panel to a door frame, and a latch driving mechanism connected operably to the bolt for moving the bolt between extended and retracted positions, said latch bolt operating device comprising:

an exterior operating unit including:

a key-operated plug-and-cylinder lock assembly having a front part formed with a radial flange, a rear part, and an actuating member which extends axially from said rear part and which is adapted to engage operably the latch driving mechanism of the latch bolt unit to move the bolt between the extended and retracted positions; and

an exterior housing including an outer annular cover, an inner annular cover and an annular shield;

said outer annular cover including a first front end portion and a first rear end portion, said outer annular cover being formed with a first axial hole which extends through said first front and said first rear end portions to permit extension of said rear part of said lock assembly therethrough, said first front end portion having a first annular recessed section around said first axial hole for receiving said radial flange of said lock assembly therein, said first rear end portion being formed with a first annular shoulder which includes a first radial part that extends outwardly from said first rear end portion, and a first axial part that extends rearwardly from said first radial part;

said inner annular cover being received in said outer annular cover and having a second front end portion, a second rear end portion and a second axial hole which extends through said second front and said second rear end portions to permit extension of said rear part of said lock assembly therethrough, said second front end portion having a second annular recessed section around said second axial hole for receiving said first annular recessed section of said outer annular cover therein, said second rear end portion being formed with a second annular shoulder which includes a second radial part that extends outwardly from said second rear end portion, and a second axial part that extends rearwardly from said second radial part;

said annular shield extending into said second rear end portion of said inner annular cover and being formed with a central hole through which said actuating member of said lock assembly extends;

said second axial part being bent so as to clamp a peripheral portion of said annular shield toward said second radial part in order to retain said annular shield in said inner annular cover.

6. The latch bolt operating device as claimed in claim **5**, wherein said first axial part of said first annular shoulder is provided with at least one inwardly protruding boss that abuts against said second axial part of said second annular shoulder to retain said inner annular cover in said outer annular cover.

7. The latch bolt operating device as claimed in claim **6**, wherein said boss is formed by punching said first axial part of said first annular shoulder in a radial inward direction.

8. The latch bolt operating device as claimed in claim **5**, wherein said annular shield has an inner peripheral portion formed with a rearwardly and axially extending annular extension which is adapted to extend into a door hole that is formed through outer and inner sides of the door panel and which is adapted to abut against a wall surface of the door hole.

9. The latch bolt operating device as claimed in claim **8**, wherein said second front end portion of said inner annular cover is formed with a tubular post which extends rearwardly and axially from said second annular recessed section.

10. The latch bolt operating device as claimed in claim **9**, wherein said annular extension of said annular shield has a radial inward end wall with an inner peripheral portion that is provided with a plurality of angularly spaced and forwardly extending guide blocks, said guide blocks engaging slidably said tubular post of said inner annular cover.

11. The latch bolt operating device as claimed in claim **10**, wherein said guide blocks are formed by punching said end wall of said annular extension in an axial forward direction.

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